treatment of the subject from the practical standpoint as thoroughgoing and suggestive.

Since the psychology of individual variation in handwriting characteristics is still an unwritten chapter of the science, it is not surprising that the analysis of handwriting habits in the volume under consideration should be largely in terms of the writing system learned by the penman and of the writing instruments and material utilized by him. Such an analysis is accompanied by an historical account of the rise of various systems of handwriting and by a description of their characteristics. The dependence of many peculiarities of writing, such, for example, as shading, upon pen position, should be noted by the investigator of the subject. The author insists upon the use of a sufficient amount of proved handwriting as a standard for comparison in the case of a disputed document and records instances of normal variation in handwriting in such a way as to show forgery by a tracing-process in the case of unnatural uniformity. The interesting observation is made that individual writing habits are found to be revealed more clearly in minor details than in striking features, such as large capital forms. Possibly the author might, with profit, have treated at greater length variations in handwriting due to age, disease and emotional disturbance.

The author insists that the testimony of the handwriting expert should, if acceptable, be the expression not of an opinion founded upon more or less vague intuitions, but of a scientific conclusion from facts, a conclusion based upon reasons which are intelligible to the non-expert and presentable in court. The author is sceptical of testimony that concerns itself with the general appearance of handwriting rather than with accurate analysis and measurement. He is, naturally, amused by the pretensions of the graphologists who would read from handwriting the physical characteristics of the penman and catalogue therefrom his vices and virtues.

The application by the author of the methods used in identification of handwriting to the study of questioned typewriting shows a new field of inquiry, one that appears well worth working by the expert.

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Tables for the Determination of Common Rocks. By OLIVER BOWLES, M.A., Instructor in Geology and Mineralogy, University of Minnesota. 16mo. Pp. vii + 64. New York, D. Van Nostrand & Co. 1910. $0.50.

This text is designed to meet the need of suitable tables for the determination of rocks and rock-forming minerals by microscopic methods and constitutes a convenient and useful pocket guide for field and laboratory purposes.

The usual classification of rocks is given but no attempt is made to group them in the tables accordingly. The grouping, based upon texture, is I., Glassy; II., Ashy or Cellular; III., Crystalline, even grained; IV., Porphyritic; V., Dense and Finegrained; VI., Banded; VII., Fragmental. The various types are arranged in the proper group and described briefly. In the case of crystalline rocks, mineral composition is made a basis for further subdivision and one chapter is given to tables for the determination of the more common rock-forming minerals, the classification being based upon color, hardness and cleavage.

The last chapter contains a short discussion of building stones. Terms used in the text are amply defined in a glossary at the end of the book.

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SCIENTIFIC JOURNALS AND ARTICLES

THE contents of the *American Journal of Science* for March are:

"Transmission of Light through Transparent Inactive Crystal Plates, with Special Reference to Observations in Convergent Polarized Light," F. E. Wright.

"Separation and Estimation of Barium Associated with Calcium and Magnesium, by the Action of Acetyl Chloride in Acetone upon the Mixed Chlorides," F. A. Gooch and C. N. Boynton.

"Feldspar Aggregate Occurring in Nelson County, Virginia," W. M. Thornton, Jr.

"History of the Coconut Palm in America," O. F. Cook.

"New Mink from the Shell Heaps of Maine," F. B. Loomis.

THE first number of the new journal, *Phytopathology,* has just appeared. This periodical is the official organ of the American Phytopathological Society. It is to be published bimonthly and to be devoted to both the purely scientific and practical economic features of plant disease investigations. The chief editors are Dr. L. R. Jones, professor of plant pathology, University of Wisconsin; Dr. C. L. Shear, plant pathologist, U. S. Department of Agriculture, and Professor H. H. Whetzel, professor of plant pathology, Cornell University; who are assisted by twelve associate editors, representing different institutions and sections of the country. The initial number contains 37 pages and 6 plates. An excellent portrait of Anton de Bary, hitherto unpublished, appears in the frontispiece. The following articles are included:

"Anton de Bary" (with portrait), Erwin F. Smith.

"The Rusts of White and Red Clover," Frank D. Kern.

"Crown Gall of Plants," Erwin F. Smith.

"Fig Diseases," C. W. Edgerton.

"Floret Sterility of Wheats in the Southwest," Edw. C. Johnson.

"Black-leg or Phoma Wilt of Cabbage," Thos. F. Manns.

"A New Fruit Spot of Apple," W. M. Scott.

Reviews.

SPECIAL ARTICLES

A KINETIC THEORY OF GRAVITATION[1]

EVER since Sir Isaac Newton enunciated the law of universal gravitation, more than two hundred years ago, philosophers have speculated on the nature of the mysterious agency which links every atom of matter in the universe with every other atom. Newton was unable to offer any adequate explanation.

Since Newton's time several theories of gravitation have been proposed, but all, of which I am aware, are open to strong objections and are not considered even promising by physicists.

Study of the nature of gravitation is beset with unusual difficulties; because gravitation is ever with us and about us, it is the one universal phenomenon, and we can not escape from its influence—can not obtain any outside point of view.

Gravitation is often described as a feeble force; and so it is, from one point of view. It is difficult to measure, or even to detect, attraction between two small bodies. But when the bodies are of planetary size the aggregate attraction of their molecules is enormous. It is easy to calculate that the attraction between the earth and the moon, which is just sufficient to retain the latter in its orbit, would, if replaced by a steel cable, require that the cable be about five hundred miles in diameter in order to withstand the strain. Between the earth and sun, the cable would have to be nearly as large in diameter as the earth; and attraction between the components of some double stars is millions of times greater than between the earth and sun (Lodge). So tremendous a phenomenon as gravitation, a phenomenon compared with which all others seem trivial, must have a mighty origin.

That gravitation is a phenomenon of the all-pervading ether is beyond reasonable doubt. This is so generally conceded that it need not be argued. But how does the gravitative influence originate? how is it transmitted and maintained? what is the *mechanism* of gravitation? It is the purpose of this paper to attempt an answer to these questions.

Let us consider what happens to a falling body. We know that it gathers kinetic energy from some source, as evidenced by its acceleration; that this energy may do external work or develop heat; that the amount of energy gathered is measured directly by the distance fallen through (within the limits of uniform gravitation), irrespective of the time or rate of falling. When the distance fallen through is of inter-planetary magnitude, and the attracting body large, the gathered energy

[1] Read before the American Association for the Advancement of Science, December, 1910.